

DISCOVERY OF A BREEDING GROUND OF THE GREATER ADJUTANT *LEPTOPTILOS DUBIUS* AND THEIR CONSERVATION IN THE FLOODPLAINS OF BIHAR, INDIA

ARVIND MISHRA^{1,2} AND JAI NANDAN MANDAL¹

¹Mandar Nature Club, Anand Chikitsalaya Road, Bhagalpur 812 002, Bihar, India.

²Email: mncarvind@hotmail.com; mncarvind@rediffmail.com

A new breeding population of the Greater Adjutant has been discovered in Bihar in the Ganga and Kosi river floodplains (*diara*) in 2006-07. Earlier its breeding was reported only from Cambodia and Assam (India). This breeding population was found almost restricted to a single colony in the Important Bird Area, Kursela river course and floodplain (*diara*). First site was at Ganga *diara* (25° 15.142' N; 86° 48.480' E) in Bhagalpur district, where two nests were located on a single tree in October 2006. We surveyed nine districts of the state, mostly north to the Ganga river up to the border of Nepal. Sixteen nests were found in Kosi *diara* on four trees by the end of January 2007, where the Greater Adjutant had successfully bred. In 2007-08, of the 35 nests recorded on 10 nesting trees, 9 in the Kosi *diara* and 1 in Ganga *diara*, 32 nests were successful.

The conservation efforts and surveys continued for two successive seasons, i.e., 2006-2007 and 2007-2008. In 2006-2007, 25 juveniles and in 2007-2008, 64 juveniles fledged from the nests, of which 8 were from Ganga *diara*, and 56 were from Kosi *diara*. Globally, the population of this rare Stork is declining, whereas in Bihar its population has shown a remarkable increasing trend in recent years.

Key words: Greater Adjutant, *Leptoptilos dubius*, new breeding ground, conservation, increasing population trend

INTRODUCTION

The Greater Adjutant *Leptoptilos dubius* is probably the rarest and most endangered stork in the world; categorized in the Red list of IUCN (2008) as Endangered. The recent estimate of its total population is 650-800 individuals (Wetlands International 2006). It was known to breed only in Cambodia and Assam (India). Once abundant in many Asian countries, till the beginning of twentieth century, it has become rare or extinct from most of its past distribution range, and is now confined to the Brahmaputra Valley of Assam, India (Saikia and Bhattacharjee 1989; Rahmani *et al.* 1990), with a small breeding population of 100-150 in Cambodia (Mundkur *et al.* 1995). The recently discovered population of Greater Adjutant in Bihar has probably not been considered while estimating the total world population. Presently, this endangered species has been placed under schedule IV of Wildlife (Protection) Act, 1972, Amendment Act, 2006 (39 of 2006).

After the discovery of a few nests of the Greater Adjutant, we approached the Wildlife Trust of India (WTI) who supported us with a Rapid Action Project (RAP) under their Wild Aid Program for the protection of the breeding colony.

The prime objective of this project was to provide direct protection to the Greater Adjutant from any disturbance in their breeding ground, hunting by Banpar – a nomadic hunting tribe locally known as 'Gulgulwa', protection of nesting trees, reducing the chance of mortality of chicks due

to accidental fall, locating other nesting sites in the adjoining area, spreading awareness among the locals and taking advocacy measures for the protection of the species and their habitat.

Background

Since the beginning of this century, the Greater Adjutant was being regularly reported foraging in and around the river course of Ganga in the Bhagalpur district, Bihar. Some old records exist from north Bihar, i.e., one in July 1901 from Darbhanga (Inglis 1904), one in April 1988, from Purnea (Rahmani *et al.* 1990), eight in March 1981, from Kishanganj (N. Krabbe pers. comm. in 1985), and six in April 1988, from Kursela (Rahmani *et al.* 1990). The best survey count of 53 individuals of this species was recorded in Vikramshila Gangetic Dolphin Sanctuary, Bhagalpur in May, 2006 (Choudhary and Mishra 2006). This was indicative of a breeding population somewhere nearby. The breeding of Lesser Adjutant *Leptoptilos javanicus* (LA) was also reported for the first time in Bihar in 2004 (Mishra *et al.* 2004, 2006). This was also suggesting the possibility of finding the breeding of Greater Adjutant in this area.

STUDY AREA

An extensive survey was conducted from mid March to end April 2007, in the nine north-eastern districts of Bihar, namely Bhagalpur, Khagaria, Katihar, Purnea, Madhepura,

Saharsa, Supaul, Araria and Kishanganj in an area between 25° 15.141'-26° 31.646' N and 86° 08.345' -88° 09.165' E, extending up to the border of Nepal in the north and Bangladesh in the east.

Though, the main breeding colony of Greater Adjutant was found at Kadwa *diara* Panchayat in the Kosi river floodplains, adjacent areas like Khairpur Panchayat, Dholbajja and Chausa also seemed to be potential breeding sites.

Ganga diara

In Ganga *diara*, the nests of Greater Adjutant were first located in 2006 at Naya *tola* Basa of Motichak near Sultanganj in the district of Bhagalpur (25° 15.142' N; 86° 48.480' E). In 2007, the nests of Greater Adjutant were built in Madhopur-Manharpur villages, about 18 km north-west to Bhagalpur (25° 15.765' N; 86° 51.406' E).

These sites are a little away from the road and less frequented by people. But the farmers have their settlements for agricultural and dairy purpose here. The area remains inundated during the monsoon but in the remaining months, the main crops cultivated are maize, wheat, pulses, oil yielding seeds, and potato. *Parthanium hysterophorus* and *Cannabis sativa* are the major problematic weeds in the cultivating fields. Some bamboos and trees, such as *Acacia nilotica*, *Bombax ceiba*, and *Ficus religiosa* are found scattered in the crop fields, but there were no bamboos under the tree where birds were found breeding. People were found helpful in protecting these birds.

Kosi diara

According to villagers, the Greater Adjutant have been found breeding in the Kadwa Kosi *diara*, north to the Kosi river since the last 10-15 years while some report their breeding since the last 25 years. They are breeding here in different *tolas* (villages), namely Kasimpur, Ashram *tola*, Lakhminia, Khairpur, Pratapnagar in the Bhagalpur district, and Khalifa *tola*, in the Madhepura district, at the border of Bhagalpur district.

These sites are at an aerial distance of about 23 km north-east of Bhagalpur and about 28 km north-east from the Ganga *diara* breeding sites on the northern-most boundary of Bhagalpur district at the border of Madhepura.

The area is under agriculture and some large trees, such as *Ficus religiosa*, *Bombax ceiba*, *Ficus infectoria*, *Ficus bengalensis*, *Syzigium cumini*, *Gmelina arborea*, *Dalbergia sisso*, *Ficus glomerulata*, *Acacia nilotica*, and *Terminalia arjuna* were observed in the area. There are orchards of *Mangifera indica* and *Litchi chinensis* at a few places. The orchards of *Bombax ceiba* are grown for commercial purposes. Bamboo is commonly grown for commercial as

well as for household purposes. The main crops of the area are maize, wheat, pulses, oil yielding seeds and potato. The area is affected by flood almost every year. However, the land is not eroded by flood water as is the common character elsewhere in flood affected areas, where rivers and water channels change their course frequently. The villages are devoid of electricity, telephone lines and other basic facilities and the area is not easily accessible.

The Greater Adjutant was seen breeding on trees in the middle of the cultivating fields and also in the courtyard of village houses.

METHODOLOGY

The surveys were accomplished using four wheelers, two wheelers and boats, but at times we walked on foot where approach was inaccessible by any vehicle. The settlements of Banpar, a nomadic hunting tribe, were also identified.

Locals were appointed at both Ganga and Kosi *diara* to observe the birds and report to us. They were provided mobile phone, binocular, camera and data collection sheets to note observations. Safety nets, made of thick nylon lined with soft muslin cloth were placed under a few trees initially to protect the hatchlings/chicks/fledglings from casualty in case they fell from the nest. This measure had been effective in protecting the chicks of Greater Adjutant in Assam, where the fallen chicks were relocated to the nests. In case of rejection by the parents, the chicks were hand-reared. The only option available was the local village veterinary doctor, who could provide immediate medical care to the chicks during emergency. The forest officials at local and state level, and zoo authorities at Patna, were contacted to provide the transport and medical facilities to the injured birds.

Placing of safety nets did not prove much useful in this case as falling of nests was not common, also it did not protect the falling chicks where bamboo grew under the trees.

For creating awareness, village meetings were arranged in the breeding and foraging grounds of the Greater and Lesser adjutants, signage were erected and pamphlets were distributed. The villagers, local leaders of *gram panchayat* (village council), teachers, school students, village elders, local political workers and police officers were also involved in the meetings to support the awareness programmes. The print and electronic media were contacted to add value to our conservation efforts. As a conservation measure, the adjutants were linked with religious beliefs, epics, spirit and mythology.

OBSERVATIONS

During our regular bird watching trips, two pairs of

Table 1: Ganga *diara* (Flood Plains) Site 2007-2008

Place	Location	Tree	No. of Nests	No. of Chicks / Juvenile
Manharpur - Madhopur (Dist: Bhagalpur) 25° 15.765'N and 86°51.406'E	South of Ganga River	Peepal tree (<i>Ficus religiosa</i>)	4 nests of GA and 3 nests of LA on the same tree	Chicks / juveniles of GA (3+1+2+2)

Greater Adjutant were observed building nests on *Bombax ceiba* in October 2006, in the Ganga *diara* at Naya *tola*, Motichak in the Bhagalpur district; there were seven nests of Lesser Adjutant on the same tree. The Greater Adjutant had build nests here for the first time, while the Lesser Adjutants are known to breed since 7-8 years. This is the first report of Greater Adjutant nesting outside Cambodia and Assam (India) in 50-60 years. But in January, both the nests were dismantled due to unknown reasons. Only some broken pieces of fresh egg shells were found under the tree with some yolk.

Subsequently, nine districts of the state were explored, and a new breeding colony of Greater Adjutant was discovered in the Kosi Kadwa *diara* with 16 nests recorded by end January 2007 (Table 2). The nests were protected by appointing watchers, placing safety nets under the trees and spreading awareness. Twenty-five chicks fledged successfully from the Kosi Kadwa *diara* by end May 2007.

During 2007-2008, no nest of Greater Adjutant or Lesser Adjutant was build at the old site on *Bombax ceiba* at Motichak in Ganga *diara*. They had visited this tree in August 2007, but did not attempt to build a nest as a troop of Hanuman Langur had stayed on this tree for two days and scared all the Adjutants. There seemed to be no other disturbance at this breeding site, other than that by Langurs as reported by the local people.

In October 2007, Lesser Adjutant were found about one km south-east from the original site, while Greater Adjutant had shifted about 6-7 km south-east to Madhopur-Manharpur villages (Table 1). Both Lesser Adjutant and Greater Adjutant had arrived at this site for the first time for breeding. According to the locals, Lesser Adjutant had arrived

since July, while the Greater Adjutant followed a little later.

The Greater Adjutant generally breeds in colonies. At a site in Ganga *diara*, we recorded four nests on a huge *Ficus religiosa* along with three nests of the Lesser Adjutant on the same tree. Altogether, seven nests were found, in addition to one incomplete nest on the tree. All the four nests were successful and by the end of third week of April 2008, eight juveniles fledged. This appears to be first successful breeding record of the Greater Adjutant in the Ganga *diara*.

In December 2007, 31 nests were recorded in the Kosi *diara*. Three were dismantled later for unknown reasons, and out of remaining 28 nests, 56 chicks fledged.

With further support from the Rapid Action Project of the Wildlife Trust of India, conservation measures were taken from March 2007 to May 2008 to protect these breeding birds in both Kosi and Ganga *diara*. The impact of awareness undertaken in 2006-07 was seen in 2007-08. From 32 successful nests, 64 chicks (Table 3) had hatched, but 61 ultimately survived (Table 4). This when compared to 18 nests built in 2006-2007, 16 were successful and 25 juveniles were added to the Greater Adjutant population in Bihar.

The Greater Adjutant has been reported breeding in Kadwa Kosi *diara* since the last 10-15 years, but their population has not increased much during this period. This was probably due to the number of threats the birds were facing, and because the locals were not aware about the importance of this highly endangered species.

For the last two years, the Greater Adjutants build nests in the Ganga *diara*. This is certainly a positive sign for the Greater Adjutant as they have extended their breeding range to Ganga *diara* after establishing their colony at Kosi *diara*.

Table 2: Kosi *diara* (Flood Plains) Sites 2006-2007

Place	Trees	No. of nests	No. of Chicks/Juvenile
Kasimpur (25° 27.366'N, 87°02.656'E)	Peepal tree (<i>Ficus religiosa</i>)	6 nests of GA	Chicks / juveniles of GA -12 (2+2+2+2+2)
Ashram <i>tola</i> (25° 27.687'N, 87°03.472'E)	Pakad (<i>Ficus nitida</i>)	7 nests of GA (1 dismantled, 1 abandoned)	Chicks / juveniles of GA-7+ (1 died) 1+1+2+1+2
Lakhminia (25° 27.755'N, 87°03.698'E)	Gambhar (<i>Gmelina arborea</i>)	1 nest of GA	Chicks / juveniles of GA-2
Lakhminia (25° 27.760'N, 87°03.688'E)	Peepal tree (<i>Ficus religiosa</i>)	2 nest of GA	Chicks / juveniles of GA-4 (2+2)

Table 3: The details of different sites of Kosi *diara* in the 2007-08

Place	Trees	No. of nests	No. of Chicks/Juvenile
Kasimpur (25° 27.366'N, 87° 02.656'E)	Peepal tree (<i>Ficus religiosa</i>)	4 nests of GA	Chicks / juveniles of GA-8 (3+1+2+2)
Kasimpur (25° 27.390'N, 87° 02.465'E)	Kadamb (<i>Anthocephalus cadamba</i>)	1 nest of GA	Chicks / juveniles of GA-2
Kasimpur (25° 27.238'N, 87° 02.485'E)	Semul (<i>Bombax malabarica</i>)	2 nests of GA and 2 nests of LA	Chicks / juveniles of GA-2 (1+1)
Ashram <i>tola</i> (25° 27.687'N and 87° 03.472'E)	Pakad (<i>Ficus nitida</i>)	3 nests of GA (3 other dismantled)	Chicks / juveniles of GA-8 3+2+2+1 (without nest)
Lakhminia (25° 27.755'N, 87° 03.698'E)	Gambhar (<i>Gmelina arborea</i>)	1 nest of GA	Chicks / juveniles of GA-2
Lakhminia (25° 27.760' N, 87° 03.688'E)	Peepal tree (<i>Ficus religiosa</i>)	11 nest of GA	Chicks / juveniles of GA-23 (3+2+2+2+2+2 +2+2+2+2+2)
Khairpur (25° 27.819'N, 87° 03.312'E)	Peepal tree (<i>Ficus religiosa</i>)	2 nest of GA	Chicks / juveniles of GA-3 (2+1)
Khalifa <i>tola</i> (25° 28.481'N, 87° 03.162'E)	Peepal tree (<i>Ficus religiosa</i>)	1 nest of GA	Chicks / juveniles of GA-2
Pratapnagar (25° 26.367'N, 87° 03.209'E)	Kahwa (<i>Terminalia arjuna</i>)	3 Nests of GA	Chicks/ juveniles of GA-6 (2+2+2)

The tree owners were annoyed with the breeding Greater Adjutant as they littered the ground and excreted on their cattle causing wounds. On the other hand, children were seen collecting fish dropped by the parent bird while feeding its juveniles.

The detail accounts of different sites of Ganga and Kosi *diaras* are shown in the Tables.

Threats in the breeding ground

Some major threats to Greater Adjutant observed during our study were by Banpar, a nomadic hunting tribe that often steal eggs, and kill birds and their chicks. Felling and chopping the nesting trees, natural disaster like thunder storm, falling of nests and chicks, accidental trap of juveniles in fishing nets, lack of awareness among the people, annoyance caused to the villagers by breeding birds by littering the courtyard and excreting on the cattle, disturbance by the tree dwelling animals, such as Hanuman Langur and increasing population

of nesting Lesser Adjutant in the breeding zone of Greater Adjutant, were some of the threats in the breeding ground.

Threats and efforts in the foraging ground

The Greater Adjutant remains at risk in its foraging ground, especially when juveniles come to feed. Some instances of their being trapped in the nets of fishermen have also been reported. On one such occasion, one juvenile was beaten to death with a bamboo pole by a fisherman in June 2007. Probably the young bird had gone in search of an easy catch from the fishing net.

A juvenile was caught in a village at Bhawanipur, Narayanpur while foraging in early May 2008. This was reported in a leading Hindi newspaper, *Dainik Jagran*. The children were playing with this bird while the villagers surrounded it out of curiosity. The area is well-known for bird trading on National Highway 31, especially ducks, waders, Bank Myna *Acridotheres ginginianus*. This place is

Table 4: Mortality of Greater Adjutant

	Nesting trees	Confirmed Mortality	Other Mortality Reported	Nests Fallen / Destroyed	Nests survived	Estimated mortality by falling of nest	Chicks Survived
2006-2007	5	4	5	3 + 4*	16	14	25
2007-2008	10	4	9	3	32	5	61

* - these 4 nests were destroyed by the locals

about 16 km north from the Ganga *diara* breeding site and about 25 km south-west from the Kosi *diara* site in aerial distance. With the help of policemen and a press reporter, the bird was rescued and released to join its flock again. Two days later, a juvenile was found dead in the crop field of Ganga *diara* in the same area. It seemed to have died about 10 days ago and had probably fallen prey to a predator.

Caring the injured chicks/Juveniles

In March 2007, a chick at Ashram *tola* had fallen from the tree on the ground and was badly injured in the head and neck region due to the bamboo spikes. A local veterinary doctor dressed the wounds with Savlon, an antiseptic solution. The chick seemed to be about a month old and weighed around 5.5 kg. At this stage (about 5 weeks) the chicks try to leap in the air (Singha *et al.* 2003) and fall from the nest. It was conscious and standing on its feet. Further, the chick had been injected with Dexona (a steroid) 1.5 ml, Neurobion (Vitamin) 1.75 ml and Penicillin (antibiotic) 1.25 ml. As no food was immediately available to feed the chick it was given a little Electral (ORS) powder which it regurgitated. Since we were new to the villagers, they were suspicious about our interest in Greater Adjutant. We therefore did not transport the chick to the city where some qualified veterinary could have treated him. We decided to relocate the chick back to the nest from which it had fallen. With the help of a gunny bag folded to half its length, the chick was relocated in its nest, where another one was already present. All the adults and juveniles (about 10-12) had left the tree during this process and had taken shelter on another tree about half a km away. They returned gradually after about half an hour. Unfortunately, the next day the chick had fallen again and was found lying dead on the ground. Probably the parents had rejected the injured chick.

On another occasion, in the first week of April 2008, due to a severe thunder storm and rain, two juveniles were seriously injured at Kasimpur. One died immediately while the other suffered a leg injury. This injured bird could not be traced for a couple of days and was later found in a maize field. We took assistance of the Divisional Forest Officer, Conservator of Forest, Chief Conservator of Forest, and zoo authorities at Patna to provide better treatment and facilities to this injured bird. But, before it could be transported to the zoo, the bird died. The juvenile was buried in the soil with salt, prior to which the wife of a local villager offered flowers, incense stick after taking a bath as it is done in the rituals of a human death. The people in the area have developed religious regard to these Adjutants as a result of our campaign. They believe that these birds called "Garud" are the carriers of Lord Vishnu.

Population Estimate

Fifty-three Greater Adjutants were seen foraging in the river course of Ganga in May 2006 and 25 individuals had fledged in 2006-07. During monsoon (July to September), such floodplains in the region are difficult to access, and thus we could not monitor these birds. It appears that there was a population of at least 78 individuals of Greater Adjutant existing in this part of Bihar in 2007.

During the season, 2007-2008, 35 nests were built (3 were dismantled) by Greater Adjutant in Kosi and Ganga *diara*. This confirms the presence of at least 70 (35 x 2) adults. We found 64 juveniles during our study. The number of adults and juveniles totals to 134 individuals. The 25 juveniles fledged last season may not have grown enough to breed. The Greater and Lesser adjutants become sexually mature at 3-4 years (Bhattacharjee and Saikia 1996). If we add that number, the total estimate suggests about 159 individuals in the state in 2008. Three died, thus the final estimate is 156 individuals of Greater Adjutant in Bihar. This newly discovered population in Bihar has probably not been considered while estimating the total global population of this species.

Nesting materials

The Greater Adjutant was observed using nesting materials from the trees of *Dalbergia sisso*, *Bambusa* sp., *Acacia nilotica*, *Pithecellobium dulce*, *Cannabis sativa*, *Solanum melangina*, *Parthenium hysterophorus*, *Sesbania* sp., *Saccharum munja*, *Croton* sp., *Ficus religiosa*, *Bombax ceiba*, *Gmelina arborea*, *Anthocephalus cadamba*, *Terminalia arjuna* and *Ficus infectoria*. During 2006-07, *Solanum melangina* twigs were found to be the major component of the nests built on *Bombax ceiba* at Naya *tola*, Motichak in Ganga *diara*. Later, these nests were dismantled in mid-way probably because it was weak in nature and could not sustain the weight and activities of the breeding Greater Adjutant.

Food

Fish was the main food of the breeding Greater Adjutants. They were also observed eating snakes, frogs, bats, crabs, and unidentified beetle-like insects. Undigested remains of these animals were found under the nesting trees. Two head portions of the fish *Wallago attu* were found lying under a nesting tree. Looking at the size of one of the heads, it was apparent that the fish would have weighed around 2-3 kg. Probably these large fishes were carried from a distance of a few kilometers. Rats are also taken by the adjutants, especially when ploughed fields are irrigated, the rats come out of their holes and are caught by the Greater Adjutants. In 2007, a Greater Adjutant was seen feeding on a dead cattle in the Kosi river.

Specific observations

In Bihar, single-species nesting colonies of Greater Adjutant were found. Only at two sites, the bird was found sharing a tree with the Lesser Adjutant. One was on *Ficus religiosa* at Ganga diara, and other on *Bombax ceiba* at Kosi diara, both in 2007-08.

Greater Adjutant have been reported to start nest building activities in September and leave the nesting trees by April or early May. At some places, people have reported the birds on potential nesting trees in August, a peak flood period.

Bats have been observed as food of the adjutants during this study. Interestingly, at Ashram tola in Kosi diara, about 25 bats were observed clinging to the branches of the breeding tree below the nests, while the juveniles and adults were present.

In 2007, the juveniles left nests by mid-May, whereas in 2008, they fledged in the third week of April, i.e., almost a month earlier. We do not know the reason for this difference in the fledging period.

DISCUSSION

The population estimate of 2008 suggests the presence of at least 156 Greater Adjutants in Bihar compared to a total of 78 in 2007. The present Greater Adjutant population in Bihar is similar to that found in Cambodia. Elsewhere, the population of this species is declining (IUCN 2008), whereas in Bihar this bird appears to show an increasing trend. However, we need data of many more years to conclude whether this increasing trend is due to better search efforts and public awareness (hence more reports), or due to real increase in the numbers.

In Assam also, the population of these is probably declining; incidences of falling nests are common (Bhattacharya pers. comm. in 2003). There may be a possibility that the population of Greater Adjutant is shifting from Assam to Bihar in search of suitable places to breed. If so, then why has West Bengal, the state between these two states, not reported any incidences of breeding of this bird? Possibly, the birds prefer the large river basins of Ganga and Kosi in Bihar after the Brahmaputra river system in Assam, and find the next suitable habitat at the confluence of Ganga and Kosi rivers at Kursela. Burhi Gandak river also confluences near this breeding zone, where sufficient food and suitable habitat is available. Very often Greater Adjutants are seen foraging in this area. Breeding is not being reported in West Bengal probably due to hunting pressure or lack of suitable breeding habitat.

In Kosi diara, in the nesting area of the Greater Adjutant, the number of breeding Lesser Adjutant is also

increasing. Breeding population of Lesser Adjutants is spread over a large area in the state (Mishra *et al.* 2004; 2006), whereas, Greater Adjutant nesting is almost restricted to a pocket. During our survey in 2007, only 23 nests of Lesser Adjutants were recorded in Bhagalpur and Madhepura districts. But in 2008, we recorded 55 nests of Lesser Adjutant in the breeding area of the Greater Adjutant.

During 2006-07, not more than two chicks or juveniles were seen in any of the nest, whereas in 2007-08, three chicks / juveniles were recorded in four nests. Later, in 2008-09, a clutch of four chicks was observed in one of the nests at Kasimpur in Kosi Kadwa diara. In 2007-08, eleven nests were built on a single *Ficus religiosa* tree at Lakhminia from where 23 juveniles had fledged, whereas there were only two nests and four chicks in 2006-07 on this tree. This is possibly the result of elimination of some threat factors as a result of our campaigns during the last two seasons.

Congregation

Breeding storks flock at the beginning of the breeding season (Singha *et al.* 2003), but here a large flock of 53 Greater Adjutant in four groups of 10-15, were observed during the evening hours in the river course of the Ganga by end May in 2006 (Choudhary and Mishra 2006). It seems that the whole colony of Kadwa Kosi diara had congregated at this place just after the completion of their breeding season. This flock had both adults and juveniles. Probably such congregations take place both at the beginning and end of every breeding season. These periods may be the appropriate time to monitor population and understand colonial behaviour of the adjutants. After breeding, all the juveniles and adults leave their nests and the juveniles still tend to live in association with their parents. Therefore, we can see some large flocks.

Nests occupied by other bird species

In Kadwa Kosi diara, the Indian Black Ibis *Pseudibis papillosa* had occupied the partially destroyed nest of a Greater Adjutant on a *Ficus* tree at Kasimpur. At Lokmanpur, all the vacated nests of Lesser Adjutants on a Banyan tree were occupied by the Black Ibis. At both places high mortality of Black Ibis was recorded; crows were observed as the main predators, which destroyed their eggs and chicks.

The Black Kite *Milvus migrans govinda* was seen using the vacated nests of Lesser Adjutant and Black-necked Stork *Ephippiorhynchus asiaticus* in Ganga diara during our study. On one occasion, at Motichak in Ganga diara, after the departure of all Greater and Lesser adjutants, Black-headed Ibis *Threskiornis melanocephalus* were seen in fairly good numbers on the same tree, but they did not stay for long.

Hurdles and Constraints

The sites could not be monitored from the beginning of the breeding season. Also, the presence of the Greater Adjutant in the state could not be tracked during peak floods between July-August, due to inaccessibility and lack of resources.

Lack of treatment facilities for injured birds, bamboo growth under breeding trees, and difficult accessibility until January was our major constraint. The Pontoon bridge on Kosi river is swept away every year during flood and the *nullahs* (streams) and small rivulets remain full of water or mud, because of which the study area remains inaccessible on a number of occasions.

Lack of funds prevented extensive surveys in many of the districts where Greater Adjutants were reported earlier. Also, the existing population of Greater Adjutants in the state could not be monitored round the year. General law-and-order is also a problem which prevented surveys in certain areas.

Recommendations

1. Since the main breeding colony is restricted to a very small area in Kosi *diara* there is an immediate need to protect this breeding population, till a few more colonies are established. Else, a single threat factor may eliminate the species from the state.

2. There is a need for a long term project work, at least five years, to protect this breeding population and to study the behaviour of the two adjutant species.

3. Regular monitoring, awareness programmes, and direct protection measures should be taken at both Kosi and Ganga *diaras* to help establish these new breeding colonies.

4. Many breeding sites of Lesser Adjutants, a Vulnerable species, and a single nesting site of Black-necked Stork, a Near-Threatened species, have been observed in this IBA. Continuous awareness programmes will help in the conservation of all these stork species.

5. Special protection measures should be taken at Ashram *tola* where regular incidences of falling nests and high mortality of Greater Adjutant chicks have been observed during the last two seasons.

6. Attention is required at Lakhminia where nests of the breeding Greater Adjutant were disturbed by chopping of trees by the villagers.

7. Movement of Banpar (*Gulgulwas*), a hunting tribe, should be properly tracked, not only to protect the birds from them, but also as they may prove a good source of information.

8. Rescue and rehabilitation centres for the injured birds and chicks should be established at Kosi Kadwa *diara* and the district headquarter of Bhagalpur with a provision for a vehicle to transport the injured birds, and a veterinary doctor trained especially to treat the birds.

9. The local veterinary doctors in the Kosi and Ganga *diaras* should also be trained to treat the birds.

10. Proper monitoring of the population should be done, especially during their congregation.

11. Efforts should be made to notify this area as a Community Reserve under the Wildlife (Protection) Act, 1972.

12. There should be an advocacy to upgrade the status of Greater Adjutant from Schedule IV to Schedule I in the Wildlife (Protection) Act, 1972.

13. Plantation of suitable tree species should be encouraged. Care should be taken that plants identified as nesting material of the bird should not be destroyed or thrown far away from the nesting sites.

14. Advocacy is needed at local and higher levels; concerned government departments should be involved in conservation programmes. Socio-economic development work should be taken up. Organising programmes like *Garud Mela* (Adjutant Fair) and *Pakshi Mitra* (Friends of Birds) awards every year would encourage the locals to conserve the birds.

15. Regular video documentation would help to study the behaviour of the species.

ACKNOWLEDGEMENTS

We are grateful to Dr. Asad R. Rahmani, Director, BNHS, Dr. P.C. Bhattacharya of Guwahati University, Assam, Dr. Rahul Kaul, Dr. Sandip Tiwari, Ms. Radhika Bhagat and Mr. Samir Kumar Sinha from Wildlife Trust of India for providing valuable guidance and assistance during the project. We acknowledge the support and cooperation of Dr. Tapan Kumar Ghosh, President, Dr. Sunil Agrawal, Secretary, Dr. Tapan Kumar Pan, Dr. D.N. Choudhary, Mr. Ajay Kumar, Dr. Pramod Kumar Verma and all other members of Mandar Nature Club. We are thankful to Mr. Arvind Prakash, who helped in the surveys, the villagers of Ganga *diara* and Kosi Kadwa *diara* and the media people specially Mr. Anuj Kumar Shivlochan, Sahara Bihar, Md. Imran, IANS, Sri Kamlesh Tripathi, Local Editor, Sri Dinkar Jha, Roop Kumar, Rajesh Kumar Bharti of Daily newspaper, Dainik Jagran, who played a great role in our awareness and conservation effort.

REFERENCES

- ALI, S. & S.D. RIPLEY (1987): Handbook of the Birds of India and Pakistan, Compact Edition. Oxford University Press, Mumbai.
- BIRDLIFE INTERNATIONAL (2001): Threatened Birds of Asia: The BirdLife International Red Data Book. 2 volumes. BirdLife International, Cambridge, U.K.
- BIRDLIFE INTERNATIONAL (2008): IUCN Red List. BirdLife International, Cambridge, U.K.
- CHOUHARY, D.N. & T.K. GHOSH (2004): Sighting of Greater Adjutant Storks in the wetlands of North Bihar. *Newsletter for Birdwatchers 44(4)*: 62-63.
- CHOUHARY, D.N. & A. MISHRA (2006): Sighting of some threatened bird species in Vikramshila Gangetic Dolphin Sanctuary (VGDS), Bhagalpur, Bihar. *Newsletter for Birdwatchers 46(5)*: 68-70.
- GRIMMETT, R., C. INSKIPP & T. INSKIPP (1998): Birds of the Indian Subcontinent. Christopher Helm, London.
- GRIMMETT, R., C. INSKIPP & T. INSKIPP (1999): Pocket Guide to the Birds of the Indian Subcontinent. Oxford University Press, New Delhi.
- GRIMMETT, R., T. INSKIPP & S.P. MEHRA (2004): *Uttar Bharat Ke Pakshi*. Christopher Helm, London.
- INGLIS, C.M. (1904): The birds of the Madhubani subdivision of the Dharbhanga district, Tirhut, with notes on species noticed elsewhere in the district. *J. Bombay Nat. Hist. Soc. 16*: 70-75.
- MISHRA, A. (2004): Draft Report – Biodiversity Strategy & Action Plan for Bihar and Jharkhand. National Biodiversity Strategy & Action Plan (NBSAP), under the programme of Govt. of India.
- MISHRA, A., J.N. MANDAL & T.K. GHOSH (2004): Breeding of Lesser Adjutant from an unexplored area of Kosi region of N. Bihar. *Newsletter for Birdwatchers 44(6)*: 84.
- MISHRA, A., J.N. MANDAL & T.K. GHOSH (2006): First ever reporting of the breeding population of Lesser Adjutant in Bihar. *Mistnet 7(1)*: 6-8.
- MUNDKUR, T., P. CARR, SUN HEAN & CHHIM SOMEAN (1995): Survey of large waterbirds in Cambodia, March-April 1994. IUCN, Gland, Switzerland.
- RAHMANI, A.R., G. NARAYAN & L. ROSALIND (1990): Status of the Greater Adjutant Stork (*Leptoptilos dubius*) in the Indian subcontinent. *Colonial Waterbirds 13*: 138-142.
- SAIKIA, P. & P.C. BHATTACHARJEE (1989): Adjutant Storks at risk in Assam, India. *ICBP/IWRB Specialist Group on Storks, Ibises and Spoonbills Newsletter 2(1-2)*: 6-8.
- SINGH, S. (1974): *Bharatiya Pakshi*. Uttar Pradesh Hindi Sansthan, Lucknow. Pp. 280.
- ISLAM, M.Z. & A.R. RAHMANI (2004): Important Bird Areas in India: Priority sites for Conservation. Indian Bird Conservation Network. Bombay Natural History Society. Pp. 1200.
- SINGHA, H., A.R. RAHMANI, M. COULTLER & S. JAVED (2002): Parental investment in the Greater Adjutant Stork (*Leptoptilos dubius*) in the Brahmaputra valley of Assam, India. *Malayan Nature Journal 56(3)*: 239-264.
- SINGHA, H., A.R. RAHMANI, M. COULTLER & S. JAVED (2003): Breeding behaviour of the Greater Adjutant Stork (*Leptoptilos dubius*) in Assam, India. *J. Bombay Nat. Hist. Soc. 100(1)*: 9-26.
- Wild Life (Protection) Act (1972): 53 of 1972: As amended by the Wild Life (Protection) Amendment Act, 2006 (39 of 2006), Universal Law Publishing Co. Pvt. Ltd., Delhi, India. Pp. i-xvi & 1-108.

